

THE ANALYST.

DECEMBER, 1894.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

THE usual Monthly Meeting of this Society was held on November 7th at the rooms of the Chemical Society, Burlington House. In the absence of the President, Mr. Otto Hehner took the chair.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected as members: E. A. Hancock, St. Kitts, West Indies; T. A. Pooley, 34, Old Broad Street, E.C.; Dr. J. C. Thresh, Chelmsford; W. G. Wagner, 101, Leadenhall Street; and R. Waterhouse, 101, Leadenhall Street. As associate: Martin Priest, Apothecaries' Hall.

The following gentlemen were proposed for election as members: J. Priestley, B.A., M.D., D.P.H., Leicester; and Raymond Ross, Worcester. As associates: C. A. Mitchell, M.A. (Oxon.), assistant to Mr. Hehner; J. Lewin, assistant to Dr. Bischof.

Dr. Ashby then read the following paper:

ON THE DETECTION OF METHYLATED SPIRITS IN TINCTURES, SPIRITS, OR OTHER COMPOUNDS.

BY ALFRED ASHBY, M.B., F.I.C.

JUST four years ago I read a short paper at a meeting of this Society on "The Detection of Methylated Spirits in Tinctures, Spirits, or other Compounds." It was not published, because I had not then completed my investigation of the subject, and I have deferred making further observations bearing upon it until quite recently.

It is a simple matter which I wish to bring to your notice this evening, but I believe that anything which is calculated to facilitate the work of the public analyst, or to render the detection of sophistications of articles of human consumption more certain or more easy of execution, is fitted for our Society, and will not be without interest to its members.

If, therefore, I can show a more expeditious method for the detection of the fraudulent use of methylated spirits than has hitherto been available, I think you will deem it worthy of your consideration.

The methods heretofore proposed may be divided into two classes: first, those which attempt the detection of methyl alcohol in the presence of ethyl alcohol; and, secondly, those which depend upon the identification of acetone, which appears to be ever present in the wood spirit used for "methylating" alcohol.

It is to the latter class that the method I proposed belongs; but before describing it, perhaps it may be well to recapitulate what has already been done in both those directions.

The following methods are given by Allen in the first volume of his "Commercial Organic Analysis": a work to which one rarely appeals in vain for information on its subject matter.

1. A tedious and complicated process devised by MM. Riche and Bardy for the detection of methyl alcohol in commercial spirit which depends upon the formation of methyl aniline violet. "Ten c.c. of the sample of alcohol, previously rectified if necessary over potassium carbonate, are placed in a small flask with 15 grammes of iodine and 2 grammes of red phosphorus. Methyl and ethyl iodides are formed, and should be distilled off into about 30 c.c. of water. The heavy oily liquid which settles to the bottom is separated from the water, and transferred to a flask containing 5 c.c. of aniline. The flask should be placed in cold water, in case the action should be violent; or, if necessary, the reaction may be stimulated by gently warming the flask. After one hour the product is boiled with water and solution of soda added, when the bases rise to the top as an oily layer, which may be drawn off with a pipette after filling the flask with water up to the neck. One c.c. of the oily liquid thus obtained is next oxidized by adding it to 10 grammes of a mixture of 100 parts of clean sand, 2 of common salt, and 3 of cupric nitrate. After being thoroughly mixed, the whole is introduced into a glass tube and heated to 90° C. for eight or ten hours. The product is exhausted with warm alcohol, the liquid filtered, and made up with alcohol to 100 c.c. If the sample of spirit were pure, the tint of the liquid is red, but in presence of 1 per cent. of methyl alcohol it has a distinct violet shade; with 2½ per cent. the shade is very distinct, and still more so with 5 per cent. To detect more minute quantities of methyl alcohol, 5 c.c. of the coloured liquid are diluted to 100 c.c. with water, and 5 c.c. of this again diluted to 400 c.c. The liquid thus obtained is heated in porcelain, and a fragment of white merino (free from sulphur) immersed in it for half an hour. If the alcohol were pure the wool will remain white; but if methylated, the fibre will become violet, the depth of the tint giving a fair approximate indication of the proportion of methyl alcohol present."

2. The process of J. T. Miller. "In the case of tinctures and other liquids containing fixed matters, the greater part of the spirit should be distilled off and the test applied to the distillate. The method is based on the fact that methyl alcohol produces formic acid when treated with oxidizing agents, but that ethyl alcohol yields a mere trace of the same body. Nevertheless, the fact must not be overlooked that a trace of formic acid (or other reducing agent) is formed, even when pure ethyl alcohol is operated on. Three grammes of bichromate of potassium and 2½ c.c. of concentrated sulphuric acid are mixed in a small tubulated flask with 25 c.c. of water and 3 to 4 c.c. of the spirit to be tested. After standing for a quarter of an hour, the flask is attached to a condenser and the mixture is distilled. When 25 c.c. have passed over, the acid distillate is treated with a very slight excess of sodium carbonate, boiled down to about 10 c.c., and enough acetic acid added to impart a distinct, but feeble, acid reaction. The liquid is then treated with 0.1 gramme of silver nitrate dissolved in about 3 c.c. of water, and the whole gently heated for two or three minutes. If the solution merely darkens a little, but continues quite transparent, the spirit is free from methylic alcohol; but if a copious precipitate of dark brown or black metallic silver separates, and the tube, after being rinsed out and filled with clean water, shows

a distinct film of silver, which appears brown by transmitted light (best seen by holding it against white paper), the spirit is methylated."

3. "A. Dupré has described (*THE ANALYST*, i. 4) the following method of detecting and approximately estimating the amount of methyl alcohol in spirituous liquids: Five ounces of the spirit are distilled twice, the liquid having been rendered alkaline the first and acid the second time, about two-thirds being passed over each time. The distillate is next shaken with dry potassium carbonate, and allowed to stand twelve hours. The upper layer is then removed with a pipette, and again twice distilled, about an ounce being driven over the first, and half an ounce the second time. This last half-ounce will contain any methylic alcohol present in the original five ounces of the sample. All the distillations should be conducted in an apparatus having all the parts air-tight, expansion of the contained air being allowed for by a mercury valve. In this way the distillation can be effected without loss. About one-third of the last distillate is next diluted with about six times its measure of water, and in this spirituous liquid the alcohol is carefully determined, first by the density, and subsequently by oxidation to acetic acid, with estimation of the latter by titration with alkali. With pure alcohol, both methods should give results agreeing within 0.1 per cent. In presence of methyl alcohol, the oxidation process gives a sensibly lower result, as no fatty acid is formed by its oxidation. If any appreciable quantity of methyl alcohol be present, on opening the flask in which the oxidation is performed, a slight escape of gas will take place, owing to the carbon dioxide produced. With pure ethyl alcohol, on the contrary, a partial vacuum is formed. In a whisky to which 10 per cent. of methylated spirit was added, the specific gravity method gave 10.08 per cent. of alcohol in the diluted distillate, against 9.50 per cent. by the chromic acid method. A determination of the alcohol by Geissler's vaporimeter affords a useful check. Thus, the same whisky above mentioned gave 10.45 per cent. of alcohol by this process, owing to the presence of methyl alcohol increasing the tension of the vapour. The remainder of the distillate in which the methyl alcohol has been concentrated may be examined for that body by the tests described above."

Hehner has modified this process by measuring the quantity of chromate reduced, instead of the acetic acid produced, considering that much more decided indications could thus be obtained than by a method by which the most valuable constituent, the methyl alcohol, is really not estimated at all (*THE ANALYST*, xii. 25).

4. "The following process for testing alcohol depends on the presence of acetone, and was devised by J. E. Reynolds: 'Take 200 c.c. of the spirit, and rapidly distil off 50 c.c.; dilute the distillate with an equal volume of water, and slightly warm with addition of a few c.c. of solution of potassium hydrate. On cautious addition of mercuric chloride, the oxide at first thrown down is speedily redissolved; excess of the mercuric salt must be carefully avoided. The alkaline liquid should be filtered clear, much of the alcohol allowed to evaporate slowly, and the residue then divided in two portions. One part is to be violently boiled for a few minutes; a yellowish-white gelatinous precipitate will suddenly make its appearance if the acetone compound be present. In the second portion, dilute acetic acid, when added in excess, should produce a bulky, white, gelatinous precipitate, containing, when washed and completely dried, between 78 and 79 per cent. of mercury.'"

5. "P. Cazeneuve distils 100 c.c. of the spirit, and collects each 10 c.c. of the distillate in separate cylinders. To each fraction he then adds 1 c.c. of a solution containing 5 grammes of potassium permanganate per litre. If the sample contained wood spirit, each fraction instantly reduces the permanganate with brown coloration, owing to the presence of acetone in all the distillates. If the alcohol be free from methyl compounds, but contains an appreciable quantity of aldehyde, the first two fractions will reduce the permanganate at once, but the following portions react less rapidly. This distinction is due to the low boiling point of aldehyde, causing it to become concentrated in the first portions of the distillate."

6. "From researches by M. Duclaux on the surface-tensions of the alcohols (*Annales Chim. et Phys.* (5), xiii. 76), it appears extremely probable that methyl alcohol could be detected, and even approximately determined, in spirituous liquids by simply noting the number of drops of the sample delivered by a pipette constructed to deliver 100 drops of water. A liquid containing 20 per cent. by volume of ethylic alcohol will give 176 drops, while methylic alcohol of the same strength will give only 147.5 drops."

A. Schwicker (*Chem. Zeit.*, xv., 1891, 914) states that powdered iodine acts upon a mixture of acetone and aqueous ammonia with the production of iodoform, and that alcohol gives no reaction under these circumstances, so that acetone can be detected in its presence. This reaction, which is described in *THE ANALYST* (xvi. 191), might perhaps be employed for the detection of methylated spirit.

These methods are either complicated, tedious, or uncertain, whilst some of them require comparatively large samples to be operated upon.

For the detection of acetone occurring in the acetonuria of diabetics, Le Nobel proposed the use of a solution of 5 grains of sodium nitroprusside in one ounce of water; when equal parts of this solution and the urine are mixed, and a few drops of ammonia added, a fine red colour gradually develops if there is any acetone, varying in depth according to the quantity present.

It is this reaction between acetone and sodium nitroprusside, in the presence of ammonia, which I proposed four years ago for the detection of methylated spirit; but I am now convinced that the reaction must be also due to some other constituent of wood spirit, because the colour is much more pronounced than it could be if it were caused by acetone alone. I have not yet been able to identify the constituent to which the colour is mainly due, but it is my intention to further investigate this point.

I use a 1 per cent. solution of the nitroprusside, which should be freshly prepared each time of use, mix equal parts of it and the sample, or distillate from the sample under examination, add a few drops of ammonia, and observe the colour after standing for ten or fifteen minutes, by which time the red colour will have become fully developed if acetone or some other constituent of wood spirit is present in appreciable quantity.

When examining spirituous liquids containing no solid matter in solution, the test may be applied directly, and in that case 3 or 4 c.c. of the sample is a quite sufficient quantity to take, 5 c.c. being a convenient amount. But in other cases it is necessary to distil, and in that case I take about 25 c.c. of the sample and test the first 5 c.c. of

the distillate, and occasionally two or three successive quantities of 5 c.c. ; or in very weak solutions it may be necessary to redistil the first 25 c.c. of the distillate from 100 c.c. of the sample.

With ethereal solutions we must distil to dryness in a water-bath, using a gentle heat at first and a higher temperature afterwards, and test several separate portions of the distillate, since the first parts, although they may give a brown or orange colour, do not show the reaction, and it is only towards the end of the distillation that the red colour will be observed, even when acetone or other constituent of wood spirit exists in the sample. It is best always to examine ether in this way, because in some samples containing no constituents of wood spirit a deep brownish colour may be produced by the test.

The advantages of this method are, the small quantity of the sample required, the rapidity and ease of execution of the operation, and the production of a distinct objective reaction.

The limits of the sensibility of the reaction must necessarily vary to some extent, since the wood spirit used for methylation is of variable composition. In one instance I was able to get the reaction in the distillate from an aqueous solution containing 4 per cent. of methylated spirit which had been reduced to the strength of rectified spirit, whilst I was unable to obtain it with a similar solution of another sample of methylated spirit; but on distilling over 25 c.c. from 100 c.c. of that solution, and testing 5 c.c. of distillate from the latter, I got a strong red colour with nitroprusside. Dealing in a similar manner with a 2 per cent. solution of the same sample, reduced to the strength of rectified spirit, the reaction could be just observed, though perhaps not with absolute certainty.

When testing any fluid which is weak in alcohol, it is well to add 2 or 3 c.c. of strong pure alcohol to the distillate before mixing it with the nitroprusside solution, because an aqueous solution of that substance gives a yellow colour with ammonia, which is apt to mask a slight tinge of red, but which is prevented by the presence of a considerable quantity of alcohol.

The test will just reveal the presence of 1 per cent. of acetone in rectified spirit, and if the first 5 c.c. of a distillate from 25 c.c. are operated upon, 0.5 per cent. of acetone may be detected by it, and even 0.25 per cent. if three successive 5 c.c. of distillate are tested and compared with each other.

For the purpose of ascertaining the permanency of the reaction, in October, 1890, I put some caustic potash into a bottle of methylated spirit, and found that the distillate from the spirit still showed the reaction after 188 days. I did not try it again until exactly four years after adding the potash, and then I found that the reaction no longer succeeded.

Some methylated spirit heated with caustic potash under a reflux condenser for six and a half hours also failed to give the reaction.

The colour produced by the test must be an undoubted red if the presence of acetone or wood spirit is to be declared; an orange or brown tint is not sufficient.

The red colour caused by the addition of nitroprusside to solutions of alkaline sulphides is of a different tint, and is formed immediately without requiring the

addition of ammonia; but if the presence of ammonium sulphide were suspected, it would be best to add some soda or potash to the sample before distilling.

Amongst other constituents of wood spirit, I find the nitroprusside reaction is produced by methyl alcohol which had been purified by calcium chloride, but not by methyl alcohol made from oil of wintergreen, nor by allylic alcohol; methyl acetate gives a faint purplish colour, but no distinct reaction with the test.

Furfurol and acetal do not give the reaction; I have yet to ascertain which constituent is the chief cause of the colour reaction.

In order to determine whether methylated spirit invariably gives the reaction with nitroprusside, I asked for a sample from thirty-two methylators, and twenty-one of them have favoured me with twenty-five samples from England, Scotland, and Ireland, every one of which gave the reaction most distinctly, as did also various samples I have procured from retailers at different times, though of course the depth of colour in the samples has varied, because the composition of wood spirit is not constant.

I think, therefore, it is safe to assume that when the distillate from any alcoholic preparation gives a decided red colour with nitroprusside solution and ammonia within ten or fifteen minutes, methylated spirit is present; but in order to be able to assure myself that it would be safe to rely upon this reaction, I tried it with every preparation in the British Pharmacopœia which contains alcohol in any quantity whatever, or which is prepared from alcohol, over 160 in number, and in no instance, with two exceptions, was any red colour produced; whilst on again distilling the same preparations, after I had added some methylated spirit to them, I invariably succeeded in getting the reaction, as I did also with aconite, belladonna, soap, and compound camphor liniments made with methylated spirit, which preparations are now sanctioned by the Board of Inland Revenue; but a few preparations contain too little alcohol to admit of the identification of methylated spirit if present.

The exceptions to the trustworthiness of the test relate to paraldehyde and the collodium and collodium flexile of the Pharmacopœia. I have not found a red colour given by the test when applied directly to paraldehyde, but I have when it has been tried with distillates from that substance and several samples of collodion, although I could not be sure that pure alcohol or ether had not been used in their preparation; therefore, pending further investigation, I recommend that it should not be relied upon for testing those articles.

Nitroprusside gives no red colour with absolute alcohol, rectified and proof spirit, chloroform, chloroform made from methylated spirit, chloroform made from acetone, a sample of which I received from the late Mr. R. H. Davies, or pure ether; but it does with methylated ether, whilst with some commercial ethers it gives a brown colour, but those samples may be distinguished from methylated ether by applying the test to the distillate in the manner I have already described.

The test shows no reaction with spirit of nitrous ether made from rectified spirit, but it produces a red colour with some which I prepared from methylated spirit, and diluted with pure rectified spirit; and I obtained similar results with two samples of

it which I prepared from rectified spirit and from methylated spirit, in accordance with the formula of the London Pharmacopœia of 1851.

Three samples of potato spirit, which Dr. Vieth kindly procured in Germany for me, do not give the reaction, although one of them is of very inferior quality.

I have applied the test to distillates from brandy, whisky, gin, rum, and various kinds of wine, but in no instance was the reaction produced.

Methylated spirit now contains three-eighths of 1 per cent. by volume of mineral naphtha of a specific gravity of not less than 0.800, in addition to 10 per cent. of wood spirit, so it must be more difficult to substitute it for rectified or proof spirit in tinctures, etc., as a turbidity is produced on dilution with water. The detection of methylated spirit may, therefore, be an easier matter than it formerly was, as the distillates from it are rendered turbid by the addition of water, and the odour is perhaps more pronounced; but, on the other hand, the distillates from many pharmacopœial and other preparations become turbid on dilution with water, owing to the presence of volatile oils, and some of them possess an odour capable of masking that of the mineral naphtha, whilst it is still possible under some circumstances to procure unmineralized methylated spirit, which might possibly be used surreptitiously in the preparation of some articles; therefore, I think any reliable reaction for its detection must still be of some use.

If, in determining the substances to be used for the purpose of methylating, the Commissioners of Inland Revenue would insist upon the presence of a certain minimum amount of such of the constituents of wood spirit as most readily give the nitroprusside reaction, the detection of methylated spirit might be made more uniformly certain. It might, for instance, be stipulated that not only should 5 c.c. of all methylated spirit give a strong red colour with the test, but also that when 1 c.c. of the spirit, previously reduced to the strength of rectified spirit or to any other uniform strength, is made up to 25 c.c. with pure rectified spirit and distilled, the first 5 c.c. of the distillate shall, when tested with nitroprusside, give a red colour not less intense than that produced by the reagent in 5 c.c. of pure rectified spirit containing a certain percentage of acetone, or other constituent of wood spirit, to be decided upon after investigation.

I acknowledge with much pleasure my indebtedness to Dr. F. W. Stansfield, of Reading, for the help I have received from him in conducting the numerous experiments I have had to make for the purpose of this paper.

DISCUSSION.

The chairman (Mr. Hehner) said he thought that methods for the detection or estimation of methyl alcohol in alcoholic liquors should be divided into two classes—Continental and English, because Continental conditions were entirely different from those prevailing in England. In Germany and France methylation of spirits was not practised, and the methods of French and German chemists had for their object the determination of the exact amount of methyl alcohol in the ethyl alcohol used in commercial manufactures, as, for instance, of aniline dyes. It was very rare that this contained a large percentage of acetone, and therefore complicated methods were unavoidable. In England, on the other hand, pure wood spirit was hardly used at

all. The mistake was continually being made of comparing the methods without paying due regard to the differences in the conditions of their application, and as the expression "methylated spirit" was almost invariably understood by Continental chemists to mean "methyl alcohol," these misapprehensions had given rise to much confusion and contention. At the present time there was absolutely no definition of what was crude wood spirit. It must "stink" to a certain degree before it could be used, that was all, and the difficulty of defining a "stink" was so great that firms importing wood spirit were continually in conflict with the Customs. Whether or not Dr. Ashby's test would be adopted by the Customs, it was an exceedingly good one, and well deserved official recognition. Mr. Hehner mentioned a case occurring in his own practice which showed how desirable it would be that some such rule as that suggested by Dr. Ashby should be adopted. An importer of wood spirit mixed with alcohol the legal proportion of wood spirit, viz., at least 10 per cent., and exported the mixture to Australia, where it was tested, and found not to smell sufficiently; and although it already contained 10 per cent. of wood spirit, the Excise ordered it to be re-methylated with another 10 per cent. at the expense of the first methylator. He thought that the Society's very hearty thanks were due to Dr. Ashby for again laying his test before them in such a very detailed manner, and bringing forward such conclusive proofs as those he had exhibited before the meeting.

Dr. Dyer agreed with Mr. Hehner that the Society was very much indebted to Dr. Ashby. He had had some little experience with the Riche and Bardy test, having made several experiments with it, and had not succeeded in getting any ethylic alcohol which did not give the reaction indicative, or supposed to be indicative, of the presence of a small quantity of methyl alcohol. He would very much like to hear the experience of Mr. Allen, or any other member who had worked on the subject, which was a very important one, on account of the disputes which occasionally arose in Customs matters.

Mr. Allen congratulated Dr. Ashby on having brought this test to a practical issue. His own experience was not so large as Dr. Dyer seemed to suppose; he had never had occasion to come into conflict with the Inland Revenue officers in connection with any disputed cases, and had, therefore, not examined the published methods as critically as he might otherwise have done. The published methods were, he thought, complex or of doubtful accuracy, and he welcomed cordially this advance of Dr. Ashby's. There was one point about which he sought information, which could probably be supplied by a word from Dr. Ashby. Sweet spirits of nitre, when prepared according to the London Pharmacopœia directions, contained a good deal of aldehyde, and the orange-yellow reaction it gave with sodium nitroprusside would, he thought, be likely to interfere with the distinctness of the acetone reaction upon which Dr. Ashby's test depended.

Dr. Ashby exhibited the test applied to one portion of rectified spirit containing 2 per cent. of acetone, and to another containing 2 per cent. of aldehyde.

Mr. Allen said he thought it possible that sweet spirits of nitre made with methylated spirit would contain not more than 1 per cent. of acetone, while containing

as much as 3 per cent. of aldehyde, and in such a case he should not expect the acetone reaction to be distinct. He thought that analysts were indebted to Dr. Ashby for bringing forward his test, which, if found satisfactory in the hands of others, would certainly come into general use. Nothing found its level so readily as an analytical process, and the methods at present used in this connection were anything but satisfactory.

Dr. Ashby said there was no danger whatever of the aldehyde reaction interfering with that of the acetone. For instance, the distillate from spirits of nitrous ether made with rectified spirit gave a very faint orange colour—in fact, only a slight deepening of the colour of the nitroprusside—but the distillate from spirits of nitrous ether made with methylated spirit by himself, diluted down in the ordinary way with rectified (not methylated) spirit, gave a very distinct red reaction. The difference between two ethers, one methylated and the other not methylated, was very marked and could not be mistaken; with many perfectly pure ethers no colour reaction at all was obtained.

Mr. Cribb then read the following paper:

THE NEED FOR FULLER STATISTICS OF ADULTERATION.

By CECIL HOWARD CRIBB, B.Sc. (LOND.).

I RECENTLY wished to obtain an approximate but, as far as could be reliable, minimum estimate of the total loss to the country owing to adulteration, but, after looking into the matter a little, found the task to be an impossible one. There is no great difficulty in ascertaining with very fair accuracy the annual consumption of most articles of food. In the case of all duty-paying articles and of all imported ones, the consumption may be found in the reports of the Inland Revenue and Customs Departments and of the Board of Trade. With regard to home produce, not paying duty, valuable, and I think trustworthy, information is to be obtained from the journals of the Royal Agricultural Society and of the Statistical Society, various trade papers, and elsewhere. It is, however, with the adulteration side of the question that the difficulties begin.

As the only body to which copies of the quarterly reports of all the public analysts are sent, the Local Government Board might reasonably be expected to give the needed statistics in their reports; but those who know those somewhat tardy annuals will know that no such information is to be found in them. The percentage of samples found to be adulterated is given, but the nature and average extent of the adulteration is not stated. This being the case, I sent out, as the only other method of getting first-hand information, a printed letter to those of the County Councils which are most active as regards the adulteration question, asking for copies of their public analysts' reports for the previous year. As would be anticipated, the reports received varied enormously, hardly two were constructed on the same plan; and while some analysts barely complied with the Act, by stating only the number of samples analysed and the number found adulterated, others gave detailed information as to every case of adulteration, including not only the results of legal proceedings, but also much

other matter, often of great interest and of high educational value for the authorities for whom they were written.

It certainly seems strange that after nearly twenty years, during which the Sale of Food and Drugs Acts have been working, no uniform system of recording the results of our labours has been adopted ; and at the present juncture it is extremely important that some serious attempt should be made to place before the public an estimate, based on the best available data, of the national loss owing to the evil of which it is our duty to aid in the suppression. Of its magnitude, the majority of people have not the remotest idea, and in consequence there is no doubt that in many cases we are not yet taken seriously by the public, and that the authorities who appoint us often do so reluctantly—perhaps only at the instigation of the Local Government Board—and attach a very second-rate importance to our work.

Under these circumstances it seemed worth while to bring the whole matter before the Society ; and my main object now is to lay before you a suggestion which, if carried out, will, I think, not only result in a large addition to our knowledge as regards the prevalence of adulteration, its effect on commerce and on the food bill of the country, but will greatly increase the prestige of the Society, and tend to gradually establish it in the minds of the public at large as *the* body, and the only body, competent to express an opinion on the scientific aspects of the question, and will cause it to be generally recognized as the *source* of all authoritative information on the subject.

My suggestion is that the Society should collect statistics of the work of all public analysts in England and Wales, or better still in the United Kingdom, and should issue a comprehensive report based thereon—not a red-tape report, made up of dry and valueless tables, but one, if possible, dealing with the larger aspects of the question, with the loss caused by adulteration, and its relation to the expenditure on the suppression of adulteration, to the total expenditure on food, and to the total national income ; with the effect of adulteration (if any) on health, on commerce, and on our commercial relations with other countries, stating not only the percentage of samples found adulterated, but the nature and average extent of each kind of adulteration ; mentioning new offences, new tricks of the trade, new methods of evading the law, and all the High Court decisions which may have been given during the year.

This is, of course, a very ambitious programme, and it might be years before it could be carried out in its entirety ; but it may, perhaps should, be regarded as more an expression of what we want than of what we are likely to get, but it is at all events at what we should aim. Many other matters which have been overlooked might doubtless be suggested, but those mentioned will serve, at all events, as a basis for discussion. The matter is not one to be lightly entered into, or without due thought and preparation ; but in the belief that it is worthy of serious consideration, I propose to put briefly before you a few of the advantages which would, I think, follow the execution of the design, and then say a word or two as to methods of collecting the information required.

To commence with the least selfish reasons, such a report as has been suggested should surely be of great value, as well as of considerable interest, to the general public.

About four and a half million of our population are in some way engaged in the preparation, production, or sale of food—everyone has a personal and private interest in the matter; and surely the people who gloat over the death rate, or get excited over the census, or the number of stamps sold by the Post Office, will spare a portion of their attention for a matter of at least equal interest and importance.

Moreover, it is high time that the whole question received some share of the popular attention, in order that the many extraordinary delusions at present current on the subject should be cleared away; and for this purpose it might perhaps be possible to issue an abridged and less technical report than that intended for experts. To County Councillors and vestrymen, and all engaged in the working of the "Adulteration" Acts, the utility of such a report is obvious.

It is, however, to members of this Society individually, as well as to the Society as a whole, that this scheme should be of the most use.

There are many points of professional interest on which, for various reasons, we require information. No one, I believe, outside the Local Government Board knows even the names of those holding the 237 appointments as public analysts which up to the present have been made, much less their qualifications, the conditions on which they are appointed, and the salaries they are paid. I am not prepared to advocate the *publication* of all such details, but I certainly think they should be accessible to every member of this Society, and should be tabulated and arranged ready for production before any future Select Committee or Royal Commission.

Again, if the statistics we require are collected in the way I suggest, it would give the Society an excellent opportunity, without practically any further trouble or expense, of getting information on any points of special scientific interest or importance that may crop up during the year, such as the occurrence of abnormal milks and butters, the employment of boracic acid and other antiseptics in butter and milk. We should also probably be enabled to get by exchange copies of the annual reports of the Health Departments of various foreign Governments, such as those of the Municipal Laboratory of Paris, of the German Reichsgesundheitsamt, and the excellent bulletins of the Inland Revenue Departments of Canada, and various American States, which, if present at all, are very difficult to find in the British Museum, and, with the exception of a few copies in the library of the Chemical Society, are hardly likely to be met with in any other library in London. Some of these reports are of great value and interest, and it is much to be regretted that they should be at present inaccessible to most, if not all, of us.

It can hardly be doubted that the prestige of the Society as a whole would be greatly increased by the execution of the suggested scheme. Anyone looking at the minutes of the proceedings of the present Select Committee on Adulteration can hardly fail to be struck by the fact that the first witnesses examined were for the most part not public analysts at all, but farmers, milk dealers, butter merchants, grocers, clerks from the Local Government Board, and the Government beer and tobacco examiners; and though no doubt public analysts will have their turn, it must be admitted that we should have cut a much better figure before the public eye had we, in our *corporate* capacity, been in possession of the information which the Local Government Board representative retailed at second hand.

Further, by issuing a report of its own, the Society cannot fail to get recognized

Finally, what is perhaps the most difficult question remains—who is to do the work? Assuming that all the members of the Society are willing to do their part by obtaining and furnishing the information needed, who is to compile and edit the report? It would, of course, be unfair to add to the burden already resting on the shoulders of the secretaries, beyond perhaps asking them to distribute the printed forms, and the actual compilation must of necessity fall into other hands. I trust, however, that if this is the only obstacle in the way of the adoption of the scheme, it will not fail on that account, and I can but express my own willingness to aid in its execution to the utmost of my power.

DISCUSSION.

Mr. Allen said he was afraid that the realization of Mr. Cribb's suggestions would take a considerable time to effect. Something of the sort in an imperfect form used to be published in *THE ANALYST*, but since the death of Mr. Wigner this had fallen through. The unsatisfactory nature of the statistics already available was in some measure the result of the Local Government Board's instructions regarding the form in which reports should be made. Some public analysts assumed that the barest compliance with these instructions was sufficient to constitute a report, but he had always looked upon the official form rather as an appendix to a more detailed report, in which suggestions might be made as to the best mode of dealing with any special points which happened to arise. In the West Riding he was required to make an annual report, as well as a quarterly report, and years ago he began giving a very comprehensive table of results, the compilation of which now required an enormous amount of labour owing to the expansion that had occurred as time went on, and the difficulty in collecting the information which it was necessary to obtain from inspectors in remote parts of the district, some of whom he had never seen. This was particularly the case with regard to information as to the results of legal proceedings, and he pointed out that, if there was so large an expenditure of time and trouble involved in the making of one such report as he spoke of (which was compiled for the use of the County Council only), the collection of the elaborate statistical information which would be necessary for the practical and efficient carrying out of Mr. Cribb's ideas would, in the case of many public analysts, take up so much of their time as to render it doubtful whether they would be able to undertake it. He thought it would be an advantage to print in *THE ANALYST* a full list of the public analysts at present acting, giving the districts for which they acted, as information on this head was now only obtainable from the bluebook, and this was inaccurate. He thought Mr. Cribb deserved their thanks for bringing the matter forward, but the amount of work that would be involved in the practical carrying out of his suggestions was very considerable, and they could not ask the secretaries to undertake any more than they already had to deal with.

Mr. Richmond said that such a report as Mr. Cribb suggested would undoubtedly be read with great profit by a large number of the general public, though he did not think that it would be much improvement on that of the Local Government Board, which, although a little tardy and somewhat complicated, contained all that was

really required, including details as to convictions and the total amount of the fines imposed. This report was compiled from official sources, and thus would naturally have advantages over the purely voluntary one proposed. All public analysts in extensive practice must have felt practically certain that a considerable number of their samples were adulterated, but the adulteration not being sufficiently marked to justify an adverse report, these samples had to be passed as genuine; in fact, practically all cases of scientific adulteration would be included among the genuine samples. Then, again, differences, sometimes immense, between the standards of different places, the greater or less experience and zeal of the inspectors who collected the samples, and other causes of a like nature, would affect the proportion of samples returned as adulterated (apart from the quality of the articles themselves), and so tend to depreciate the value of this huge collection of figures, which, too, would almost certainly be incomplete, as some few at least out of the 280 public analysts would be sure to fail to report. It was very doubtful, seeing that a really complete and accurate report could not be drawn, whether it would be worth while to spend a considerable amount of time and money upon it.

Mr. Hehner said that although the desirability of some such scheme of records was beyond question, its accomplishment presented many difficulties, and it seemed to him that it ought to form part of a great scheme for the reorganization of the Sale of Food and Drugs Act. It could not be done by the secretaries, as was shown by the experience of Mr. Wigner and Mr. Heisch years ago, and he thought it would never be satisfactorily done until it was undertaken by the State. Perfection, of course, was not attained quickly, but all possible progress towards it should be made. The statistics at present available were very insufficient, and did not represent the actual state of adulteration and the consequent loss to the country at all, nor did they show in what way the country was benefited by the public analysts. It was impossible to gather whether certain forms of adulteration had died out, or whether there was any decrease in the average proportions of foreign ingredients now added, which he was certain was the case in milk, at least.

Mr. Cribb said he was sorry to see that, while everybody seemed to agree as to the desirableness of the scheme, nobody seemed to be anxious to do anything. As to who was to do the work, he would be the last to expect the secretaries to undertake it, although he thought that even they would not object to sending out the forms along with their other notices—which would give them practically no more trouble than at present. He would have liked to see the matter referred to the Council, or to a committee. He would be very glad to do his best, provided that the statistics were obtained, to collate them. The thing could, however, only be carried out satisfactorily under the aegis of the Society. At all events, a trial might be made, say for a year.

Mr. Allen asked if Mr. Cribb proposed to collect statistics from all public analysts, including those who were not members of the Society.

Mr. Cribb said he thought there would be no great difficulty in that, if the non-members were approached in the proper way.

Dr. Dyer remarked that Mr. Cribb was not a county analyst, and could,

perhaps, hardly appreciate the difficulties which county analysts would have in furnishing or being furnished with all the statistical information suggested. They had one central authority in a County Council, but this often comprised virtually a number of all but separate authorities in the local police division. An analyst who, like Mr. Cribb, was attached only to a Metropolitan parish, had all his fellow-officers within a short distance, and could easily ask for and obtain information difficult to obtain over the scattered area of a whole county.

Mr. Cribb said that his chief desire that evening was only to initiate the matter, and that it should not be allowed to drop. If it were referred to the Council or to a committee, perhaps the Society might see its way to taking some steps on the lines he had indicated.

Mr. Bevan said that it was only fair that the matter should go before the Council, as Mr. Cribb had taken a good deal of trouble and time over it. There were several things that he personally could not approve of, but Mr. Cribb himself was not finally decided as to details. Dr. Dyer and he would bring the matter before the Council at their next meeting.

Mr. Hehner said that it might be possible for the Council to try such a scheme, and to appoint a committee with that object.

Mr. Bevan exhibited two novel pieces of apparatus, illustrations and descriptions of which will appear in our next issue.

In the absence of the author, Dr. Dyer read a paper on "Roasted Chicory," by E. G. Clayton, the publication of which is unavoidably postponed.

The Resemblance between the Reactions of the Alkaloids and of Acetanilide.
E. Schär. (*Arch. Pharm.*, cccxxii., 249, through *Chem. Zeit.*)—Tafel has pointed out that anilides, such as acetanilide, give a reaction with sulphuric acid and an oxidizing agent which resembles the strychnine reaction. Flückiger has drawn attention to a similarity between the reaction of morphine with sulphuric acid, containing nitric acid, and that of acetanilide with the same reagent. Schär has tested both these statements; he finds, with respect to the strychnine reaction, that this differs in two main points from that yielded by acetanilide. (1) The play of colour shown by strychnine is from blue to methyl violet, whereas that exhibited by acetanilide is rather a blue-purple-red coloration. (2) The introduction of the oxidizing agent into the solution of strychnine in sulphuric acid induces a deep violet colour, which gradually changes—through cherry-red, purple-red, and blood-red—to yellow-red, whilst in the case of acetanilide, there is a rapid change from purple-red, through violet-red, into a dirty blue-green, olive-green, or brown-green.

The reaction of sulphuric acid, containing nitric acid, on morphine and on acetanilide is certainly very similar; but acetanilide gives no reaction with sulphuric acid which contains selenic acid, titanous acid, molybdic acid, or tungstic acid, and thus should not be mistaken for morphine. Furthermore, morphine gives a deep

red-brown colour with sulphuric acid and bismuth subnitrate, whilst acetanilide gives a dark yellow colour, becoming carmine-red at the edges of the mass.

A. G. B.

A Simple Method of Purifying Commercial Ether. M. Ekenberg. (*Chem. Zeit.*, xviii., 1242.)—For most analytical purposes, sufficiently pure ether can be easily obtained from the commercial article by mixing it with from 5 to 10 per cent. of its volume of a liquid paraffin, which boils above 300° C., and distilling at 40° to 50° C. The paraffin retains the alcohol and oxidation products in the retort, and if much water be present, this will form a layer beneath the paraffin. By heating the paraffin to 120° C., the impurities are expelled, and the oil rendered fit for further use. The method is quite efficacious in removing acids, evil-smelling compounds, and peroxides, and may also be applied for the purification of light petroleum, aldehyde, chloroform, etc.

A. G. B.

Utilization of Sodium Peroxide in Analysis. O. Kassner. (*Arch. Pharm.*, cccxxii., 226-240.)—The oxygen which is evolved from sodium peroxide in water contains ozone, a fact which probably accounts for the activity of the peroxide as an oxidizing agent.

Häussermann has shown that the addition of sodium peroxide to the solution of a chromium salt precipitates chromium hydroxide, which, at the ordinary temperature, is redissolved, and oxidized to sodium chromate; at low temperatures a brown solution of sodium perchromate, $\text{Na}_6\text{Cr}_2\text{O}_{15} \cdot 28\text{H}_2\text{O}$, is produced.

When sodium peroxide is added to a solution of uranyl nitrate the usual yellow precipitate of sodium uranate, $\text{Na}_2\text{U}_2\text{O}_7$, is formed, but is immediately redissolved; the solution gives a yellow crystalline precipitate of sodium peruranate, $\text{Na}_4\text{U}_2\text{O}_8 \cdot 8\text{H}_2\text{O}$, when alcohol is added. If the solution be warmed before the alcohol is added, it becomes red, and alcohol then precipitates a red oil, which speedily becomes crystalline, and proves to be the mixed uranate, $\text{Na}_2\text{U}_2\text{O}_8 \cdot \text{UO}_2$, discovered by Fairley.

Manganese is precipitated as hydrated peroxide when sodium peroxide is added to its solutions, but further oxidation is impossible, because permanganates are reduced by the peroxide. Similarly, iron is precipitated as ferric oxide, no ferrite or ferrate being formed.

Clark (*Trans. Chem. Soc.*, 1893, 1079) has already dealt with the separation of chromium from manganese and iron by the aid of sodium peroxide. The author claims that the results obtained by such a method are not low, as stated by Clark; thus, by adding sodium peroxide by degrees to a mixture of solutions of chrome alum and manganese sulphate, heating for some time, and washing and weighing the manganese peroxide as usual, 99.96 per cent. of the manganese was estimated, whilst 99.87 per cent. of the chromium was found by reducing the filtrate and precipitating with ammonia. By a similar procedure with a mixture of ammonium ferrous sulphate and chrome alum, 99.93 per cent. of the chromium and 99.81 per cent. of the iron were estimated.

Potassium ferrieyanide is reduced to ferrocyanide by sodium peroxide, and since

the ferrocyanide can be titrated by potassium permanganate in an acid solution, the following method may be adopted for the analysis of red prussiate: The weighed sample (0.5 gramme) is dissolved in about 100 c.c. of water, and a little sodium peroxide (0.06 gramme) is added; the solution, thus decolourized, is heated until all effervescence has ceased, acidified with dilute sulphuric acid, diluted with water, and titrated with potassium permanganate solution. A slight green precipitate may be formed by the acidification, but since this is only due to the iron oxide in the sodium peroxide, and reduces as much permanganate as the ferrocyanide reduces, it may be disregarded.

Sodium peroxide precipitates the black sesquioxide of cobalt from solutions of that metal, but only the green hydroxide from solutions of nickel. Mercury, silver, and gold are precipitated in the metallic state from the solutions of their salts by sodium peroxide; but solutions of platinic chloride and palladous chloride in hydrochloric acid are not so reduced, apparently because the double sodium salts which are first formed are stable. When the hydrochloric acid is removed by silver nitrate, both salts are reduced.

Separation and Estimation of Antimony, Tin and Arsenic.—The mixed sulphides are stirred with about 30 c.c. of cold water in a tall beaker, and sodium peroxide is added little by little until a small portion gives no coloured precipitate on acidification. The contents of the beaker are now transferred to a silver crucible, and evaporated to dryness; the residue is kept in fusion for some time, and then digested with water containing one-third of its volume of alcohol. The sodium pyroantimonate is filtered off, washed, and weighed as antimonyl antimonate in the usual manner. When the alcohol has been evaporated from the filtrate, dilute sulphuric acid is added until the liquid is feebly acid, the precipitated stannic acid is redissolved by caustic soda, an excess being avoided, and carbon dioxide is passed through the solution until it becomes turbid. By now adding ammonium chloride, heating for half an hour, and leaving the solution at rest for nearly twenty-four hours, all the stannic oxide is precipitated, and may be weighed as usual. To precipitate the arsenic, which exists in the filtrate as sodium arsenate, ammonia and magnesia mixture are added; after being allowed to remain for forty-eight hours in the cold, the ammonium magnesium arsenate is filtered, washed with ammonia, and weighed as magnesium pyroarsenate.

The figures quoted show that, in two analyses conducted in this manner, 99.86 per cent. of antimony, 99.91 per cent. of tin, and 99.75 per cent. of arsenic were recovered in the first case, and 99.67 per cent. of antimony, 99.64 per cent. of tin, and 99.83 per cent. of arsenic, in the second case.

The author claims that by this method the time of oxidation of the sulphides is reduced to a minimum (half to one and a half minutes), and that tin will not so perpetually accompany the antimony as is the case in the usual method. Moreover, if a qualitative test for arsenic in Marsh's test be required, there is no nitric acid to be expelled before this can be performed.

. For qualitative testing, the mixed sulphides are oxidized as described above, and a small portion of the solution (after it has been thoroughly boiled to decompose the excess of peroxide) is added to some acidified potassium iodide solution; a liberation

of iodine will show the presence of antimony. If this be present, the main solution is heated for some time, alcohol is added, and the pyroantimonate is filtered off. After the alcohol has been evaporated from the filtrate, this is made feebly acid with sulphuric acid and ammonium chloride is added; the precipitated stannic oxide is filtered off, and arsenic sought in the filtrate. A. G. B.

Comparative Tests of different sorts of Glass with reference to their Chemical Composition. By F. Foerster. (*Zeit. für Analy. Chemie*, 1894, Viertes Heft, pp. 381-396.)—The author gives tables of the composition of seventeen kinds of glass used for chemical apparatus, and of the manner in which they resist the attack of water, hot and cold, and of caustic alkalis. The two which offered the most resistance when treated with water at 20° for eight days, and at 80° for three hours were specimens of Schott's Jena glass, and had the following percentage composition:

	K ₂ O	Na ₂ O	CaO	ZnO	MnO	Al ₂ O ₃ +Fe ₂ O ₃	SiO ₂	B ₂ O ₃
1.	—	11	—	—	0.05	5.0	71.95	12.0
2.	—	9.8	7.0	5.0	0.3	3.5	74.4	—

No. 1 was far more readily attacked when boiled with caustic soda for three hours than were vessels made of the best ordinary glass, and is, therefore, not suitable for analyses where caustic alkalis are used. No. 2 offered about the same resistance to alkalis that good ordinary glass does, but was far less attacked by hot and cold water. On the other hand, it is difficult to manufacture chemical apparatus from it. The author alludes to another borate glass from the same manufactory which has not these disadvantages, but gives no particulars of it in his tables. C. A. M.

Contributions to the Analysis of Lard. G. Halphen. (*Journ. de Pharm. et de Chimie*, 1894, xxx., pp. 241-247).—The application of the silver nitrate test to the fatty acids instead of the fresh lard is recommended. Filtration removes substances from pure lard fatty acids which reduce silver nitrate, and thus one of the objections brought against Becchi's test is avoided. For the detection of foreign animal fat, as well as cotton-seed oil, the author, in collaboration with M. Bishop, has devised a process for taking separately the iodine numbers of the liquid and solid fatty acids in the lard.

Sear's method of separation is used. 10 grammes of the fatty acids are dissolved in 200 c.c. of CS₂ in a 250 c.c. flask. To the solution 5 grammes of ZnO are added, the flask well corked and shaken at intervals for six hours. The soluble zinc salts are separated from the insoluble by filtration. The filter is well washed with CS₂, the washings being added to the soluble salts in a tared flask. The CS₂ is distilled off, and the residue dried for an hour at 90°, while a current of dry air is passed over them. The increase of weight shows the quantity of zinc salts furnished by the liquid part of the fatty acids. To estimate the combined zinc 50 c.c. of normal H₂SO₄ are added, with constant shaking, until all the acids are liberated. These remain liquid at from 18° to 20°. The liquid in the flask, excluding the layer of fatty acid, is made up to 200 c.c. Rather more than 100 c.c. are removed with a pipette and filtered. 100 c.c. of the clear filtrate are then titrated with normal

soda, from the result of which the weight of zinc combined with 100 grammes of the fatty acid can be calculated. This is also an index of the molecular equivalent of the acids. The iodine number is determined on the acids direct.

The zinc salts insoluble in CS_2 left on the filter are decomposed by boiling with HCl , and their iodine number taken. It is noteworthy that the soluble zinc salts obtained from pure lard, beef suet, and mutton suet, are of an amber colour, while those derived from cotton-seed oil acids or from lards adulterated with cotton-seed oil are orange-red.

The following table gives the results of analyses.

Nature of Fat.	Iodine No. total Acids per cent.	Iodine No. Liquid Acids per cent.	Iodine No. Solid Acids per cent.	Soluble Zinc Salts.		Liquid acids per cent. grammes.	Solid acids per cent. grammes.	Index of Saponification in ZnO per cent.
				Weight. Grms.	Colour.			
Pure American lard ...	63.5	91.95	28.83	64.7	amber	57.14	42.86	14.7
Pure French lard ...	59.0	86.61	32.91	57.83	amber	50.72	49.28	15.8
American fat (A) ...	83.56	117.1	47.58	61.2	orange	53.86	46.14	15.4
American fat (B) ...	83.56	114.04	48.56	63.06	orange	55.6	44.4	15.2
Beef suet pressed ...	17.01	75.60	12.95	7.84	amber	6.8	93.2	15.2
Mutton suet	37.84	80.26	17.52	35.2	amber	31.44	68.56	14.5
Cotton-seed oil	02.361	129.03	49.53	78.15	orange	69.06	30.96	14.9

A further communication on the subject of mixtures is promised.

C. A. M.

EXTRACTS FROM THE EVIDENCE GIVEN BEFORE THE SELECT COMMITTEE ON FOOD PRODUCTS ADULTERATION, ON JULY 11, 18 AND 25.

MR. RICHARD BANNISTER.

(Continued from page 264.)

7. EVIDENCE REFERRING TO VINEGAR.

786. Do you think that a pure malt-vinegar is not made from simple malt?—In the vinegar trade they have followed the same lines as the brewers. At one time brewers were compelled to make beer from malt only, and then they were allowed to use malt and grain, or malt and sugars; the vinegar brewers have gone in the same line.

1795. On the question of malt-vinegar, do you agree that when malt-vinegar is asked for, it should be vinegar distilled from malt?—No.

1796. Made from malt?—Made from malt and grain; made from malt, or malt and grain.

1797. But you would not give any further latitude in the making of vinegar; or rather, when malt-vinegar is demanded, you would consider that it should be made

of malt, or malt and grain?—I should liberally read the expression “from grain,” because in some cases it has been said that the word “grain” refers to barley. If a man uses other grain, or other starchy matter, I should consider that that brewed with malt was malt-vinegar.

1831. You referred to malt-vinegar, and you said that it had to be made of malt, or malt and grain; but in using the term “malt,” do you mean necessarily malt made from barley?—No; it would include any malt.

1832. Malt may be fairly made from any wholesome grain?—Yes.

1833. And that would be included in your term “malt”?—Yes; but, as a rule, you find that nearly all malt is made from barley.

1834. But you would not necessarily require that it should be made from barley?—Certainly not.

8. EVIDENCE REFERRING TO GINGER.

2700. Have you ever found that spent ginger has been used as an adulterant to any extent?—I have had samples that I have examined that did contain spent ginger.

2701. Is there any proper commercial use for the product that is known as spent ginger?—No, unless a certain quantity of extractive matter is left in the ginger.

2702. Would the sale to the public of genuine ginger with which spent ginger had been mixed be a fraud on the purchaser?—It would depend upon the price, because the price of ginger varies greatly.

9. EVIDENCE REFERRING TO LARD.

2885. In your opinion, is the use of a moderate quantity of beef-stearine—say 10 per cent.—for the purpose of stiffening lard an adulteration?—At home, in the summer, we always used to put a small quantity of mutton-suet into the lard to keep it hard, and make it convenient to work for domestic purposes. . . .

10. EVIDENCE REFERRING TO SUGAR.

2686. If coloured or yellow crystals are sold as Demerara sugar, ought the sellers, in your opinion, to be prosecuted under the Sale of Food and Drugs Act for adulteration, or under the Merchandise Marks Act for giving a false trade description?—It strikes me that it should be under the Merchandise Marks Act, so long as the colouring-matter is so small that it does not amount to adulteration.

2687. You do not consider that the colouring process is an adulteration except beyond a certain point?—I have examined a sample that has been coloured, and the amount of adulteration by colouring is so small, that it could not be considered adulteration.

2688. Where do you think adulteration begins?—It is very difficult to say where one begins and the other ends; it depends entirely upon the article itself.

11. EVIDENCE REFERRING TO STANDARDS AND LIMITS.

829. In connection with that subject, I should like to know your opinion as to the desirability of extending the system of standards on even recognised limits. You have a legally-enacted limit in the case of spirits, have you not?—Yes.

850. What I wish is the opinion of yourself, as a member of a very important

department, as to the possibility of extending this system of known standards so that the analysts in different parts of the country might work on something like the same lines?—As far as the analysts are concerned, there is no doubt that the establishment of standards would certainly bring in unity, whereas sometimes there is discord at the present time—there is no doubt about that.

851. And they do make standards for themselves, and then you make other standards for your department, and that sometimes brings you into conflict?—Yes.

852. Is it your opinion that whereas the standards of your department, or of a central department, would be official, such a standard set up by a central official department would be more convenient and more just on the whole than a standard which may vary with the taste of each individual?—There is no doubt that it would be easier to do.

853. It is proposed, as you are aware, that there should be some central department.—I have seen the statement in the draft Bill.

854. Assuming that such a central department were set up, do you think that there would be any difficulty in at all events very largely extending the list of articles in which a recognised standard might be published?—I think there would be considerable difficulty. There is no doubt that, so far as the establishment of standards is concerned, if the standard were equal, it would be a great deal easier to work the Adulteration Act so far as the analysts are concerned. But it is quite another question for the producers; they would have something to say to that, too.

855. But do you not think it is desirable to apply the same principles, so far as possible, to all classes or articles?—Evidently, as far as you can, as long as they do not conflict with other interests.

856. Then what I ask you is, whether you have considered that the same principles as are applied to spirits and to milk and butter (that is to say, the fixed definitions of standard) could not be extended to a number of other products?—Certainly it could.

855. On the policy of these points we should not regard you, of course, as an expert witness; but there is a point on which you can give us better information, I think, probably, than anyone else, and that is about the proposal that the Chemical Court of Appeal should be changed from the Inland Revenue Department to some other department, such as the Local Government Board. You are aware that that proposal has been seriously made by the analysts?—Yes.

856. And that they express themselves as very much dissatisfied with the present system, and say that the arrangements for the Chemical Court of Appeal should be entirely remodelled? I am glad to see that you have their proposition before you.—It was given to me the last time that I was here.

857. Would you describe in your own words from the statement what has taken place?—In the first place, we have not got an Inland Revenue Chemical Department at the present time, because there has been a committee of inquiry into the different chemical works of the Government; and now we are a Government Laboratory made up of the Customs Department and the Inland Revenue Department, and have to take over the whole of the work from the other departments. With regard to the suggested Board of Reference, the suggestion is that “there shall be appointed a

board or committee, consisting of the chief chemical officer of the Inland Revenue Laboratory, a person nominated by the General Medical Council, three persons, being public analysts, nominated by the Local Government Board, and a person nominated by the Board of Agriculture." If you notice about the Board of Reference, in all the trades that are concerned, there is not a reference to those trades at all; in fact, when we look at the numbers, you will find that there are to be three public analysts, and there are to be three others.

888. So that, in the first place, you object to that proposal of a Board of Reference as an unfair composition?—Yes; it is really a reference in which, so far as the trades are concerned, they have no voice in the matter. The reference seems to me all wrong.

889. Have you anything to say on the proposal for transferring the department from the position in which it now stands to the Board of Trade or the Local Government Board?—In regard to that, I think that the first point which has to be considered is whether the Board of Inland Revenue, as referees under the Act, have done their duty, or whether they have not. If you look at the work which it has done, and the decisions that have been arrived at by the magistrates, I think you must confess that they have done their duty.

890. What I should like you to explain to the committee is the opinion of your department on the subject. I understand you to say emphatically that there is no necessity for any change?—Not the slightest.

891. And you would deprecate being put under any other department than that under which you serve at the present time?—I feel in this way. Of course, the Government of the day is the authority that I have to obey, and if the Government of the day were to say that certain things had to be done, I, as a loyal civil servant, should try to carry out their instructions to the utmost of my ability.

892. Then you consider it a question of policy, and not a question upon which you, from your official position, can express an opinion?—I think I can express an opinion.

893. And that opinion would be hostile to that suggestion altogether?—Certainly.

894. As a matter of fact, I suppose that there would be no particular difficulty in a transfer of the department from the position in which it now stands to another department?—We do the Board of Trade work now at the present time, the whole of it, and have done it for years.

895. But, as regards the Local Government Board Department, you are not in very close communication with them, apparently. You do not report to them at all, do you?—Whenever any question arises on which we have to report to the Local Government Board Department, we do report to them, but nothing beyond that.

896. I mean in connection with the administration of the Sale of Food and Drugs Act?—If there is any question that is necessary to be referred between the two departments, it is referred, but as a rule it is not necessary.

1798. Many suggestions have been made, I believe, on the part of the Society of Public Analysts, that there should be a central department having the power relegated to them that Somerset House now enjoys, consisting of six or more, or

less, perhaps, gentlemen of scientific standing, including three public analysts, who should work out methods of analysis and lay down limits and standards; do you agree with that suggestion?—I do not.

1799. I think you raised the point that the commercial interests should be represented?—Certainly. As soon as that paper was read, the very first suggestion made by a chemist and druggist was that there should be two chemists and druggists put on; you can easily see, therefore, that if you have a central board of that kind, you must have the trades represented. But I think you want a more central laboratory to do the work.

1835. Now, if a public analyst writes to you for a standard for an article, do you give it?—We give him a limit; any information that we can give him on the subject, we do give him.

1836. That is in the ordinary course of things?—Yes.

1837. Do you think these standards or limits would be well fixed, as has been suggested, by a board of analysts and scientific men?—Personally, I am opposed to standards altogether. I think that we can do a great deal better without them.

1838. If any board of analysts and other scientific people were arranged for helping the working of the Act, do you think that that, irrespective of standards, would be desirable?—I think it would not, unless everybody was represented—the scientific part and the trading part.

1839. This is the question which I wanted to come to: perhaps the analysts would not assent to that?—I expect they would not; I do not know.

1840. You think that if there is a board, the traders should in some way be represented upon it as well as the scientific element?—Certainly.

(Concluded.)

NOTE.—These extracts from the evidence of Mr. R. Bannister were compiled from the official transcript of the shorthand notes issued after each sitting of the committee. In the Blue-book which has been subsequently issued certain alterations will be met with.

REVIEW.

ADULTERATION (AGRICULTURAL FERTILIZERS AND FEEDING STUFFS). By FRANCIS H. CRIPPS-DAY, M.A. (Cantab), of the Middle Temple and Oxford Circuit, Barrister-at-Law. (London: Stevens and Sons, Limited. Price 5s.)

The author of this book disclaims in the preface any intention to produce a "complete manual upon the agricultural, mercantile, scientific, and legal sides of the subject," but seeks to introduce only "so much of each as will serve to put the farmer, the merchant, the analyst, and the lawyer in possession of a succinct introduction to any of the subjects foreign to his own profession."

In the introductory chapter the author gives a sketchy, but perhaps a sufficiently lengthy, description of the principles underlying the scientific application of fertilizers and feeding stuffs, which in the main is not calculated to seriously mislead the general reader. In the following chapter the author attempts to classify systematically the manures and feeding stuffs found in the market, but the attempt has not been very

successful. "Superphosphates (natural)" and "ammonium sulphates prepared from sewage" are described as "artificial organic fertilizers," while it is solemnly asserted that superphosphate, prepared from coprolites, is "commonly adulterated with gypsum (formed in the process)." The list of feeding stuffs omits any mention of such well-known substances as earth-nut, palm-nut, and cocoanut cakes, but includes (possibly cattle may like a "relish" at breakfast!) such substances as "fish and flesh," "herring-meal," etc.

In chapter iii. the full text of the Fertilizers and Feeding Stuff Act, 1893, is given, with notes by the author. What the exact legal value of these may be we are not in a position to decide, but some of the definitions are worth quoting. Thus, after considering the meaning of the word "fertilizer," the author offers a definition of his own: "A *fertilizer* is anything which, when applied to the soil, enters wholly or in part into the composition of the vegetable produce of the said soil. Under this definition *lime is a fertilizer, gypsum is not.*" (The italics are ours.) Again, "suitable for feeding purposes" is defined, "If the feeding stuff contains any deleterious substance, or is in a condition whereby it is unwholesome to feed cattle upon, it will not be fit for feeding purposes." It is also stated that "the frauds in the sale of fertilizers by means of dyes are not touched by the Act."

Chapter iv. is devoted to "The Analytic Evidence." It will probably be news to those analysts appointed under the Act to learn that, when called as a witness, "The district analyst *must* be asked what education he has undergone fitting him to give an expert opinion. Diplomas of Universities enable a chemist to certify as to chemical analysis, or a botanist as to certain microscopical experiments, but only a specialist in agricultural science is in a position to give the opinion as required in Forms A and C."

Pages 55-72 are occupied with a more or less accurate *resumé* of the processes used by analysts in examining fertilizers and feeding stuffs, but as the information given is in many cases wrong, and in all cases perfectly worthless to the chemist and quite unintelligible to the layman, it is difficult to understand what good can result from its publication. Interspersed with these methods are descriptions of adulterations which, in many instances, are calculated to mislead. Thus, "In the tricalcic phosphate lime is present to the amount of 38.7 per cent., whereas in basic phosphate the percentage of lime is 43.7." "Mineral superphosphate implies a minimum of 17 per cent. soluble phosphate." "The presence of . . . sand (in guano) will sustain a prosecution." It will perhaps be news to the author to learn that good genuine Peruvian guano as now imported rarely contains less than 10 per cent. of sand, and often much more. "Special tests will be made to discover what is the percentage of gelatine, if guaranteed, as is the case sometimes with North American (Cotton) cakes, it being a substance of especially nutritive value for calves." This might be necessary if cotton cake was a suitable food for calves, if it contained gelatine, and if it was the custom to guarantee in these cakes substances which are known not to be present.

The remainder of the book is concerned with translations of the French, Belgium, and German laws on the subject, and with abstracts of the United States' law, which will doubtless prove useful for reference.

A. S.

